

REPLY

We appreciate Dr. Lengyel's interest in our PRO-TEE study regarding thrombolysis of prosthetic valve thrombosis (PVT) (1). In this international registry, thrombus burden was found to be the best predictor of complications in addition to a previous history of stroke. A thrombus area of 0.8 cm² identified a threshold beyond which complications increased, *irrespective* of functional class. Thus, thrombolysis is safest in patients with thrombi ≤ 0.8 cm² and no previous stroke. In patients with larger thrombi, recommendation of thrombolysis versus repeat surgery depends on the relative risk of each modality in a particular patient (1).

Dr. Lengyel proposes to use thrombolysis in all patients with PVT, irrespective of thrombus size and functional class. This is mostly based on a series of prosthetic valves reported by Lengyel and Vándor (2) where 43 cases underwent thrombolysis and 20 underwent surgery. Mortality rate was lower with thrombolysis (2 of 43 or 5% vs. 6 of 20 or 30%). However, patients were *selected* to undergo surgery as opposed to thrombolysis if they had a left atrial thrombus, if they presented with a stroke, or if they failed thrombolysis. This selection most likely contributed to the higher mortality rate of the small surgical group and to the lower mortality of the thrombolysis group. Furthermore, it is difficult to negate the relation of thrombus burden to complications of thrombolysis in that study because thrombus length was measured in only 3 of the 30 cases of obstructed valves. In the "nonobstructed" valves, the majority of which were in New York Heart Association functional class I and II, the thrombus length was generally small. Thrombus area was not measured. We disagree with the statement that thrombus burden cannot be measured with transesophageal echocardiography (TEE) when the valve is obstructed. Indeed, this was feasible in the PRO-TEE study where we found that thrombus area was a better discriminator than thrombus length in predicting complications. Whether three-dimensional echocardiography during TEE further refines the quantitation of thrombus burden and the risk of thrombolysis remains to be determined.

Dr. Lengyel also relates that recent experience with thrombolysis (1996 to 2003) shows a lower incidence of embolic phenomena (4%) and death rate (2.5%) compared to earlier experience. These complication rates are quite low compared to most reported series, including Dr. Lengyel's (1–3). While the exact reasons for this difference may not be readily apparent, imaging with TEE prior to management decision and avoidance of patients at high risk with large thrombi are likely contributing factors. In fact, in PRO-TEE, the use of thrombolysis irrespective of thrombus size in some centers provided a wide range of thrombus burden and allowed the evaluation of the relation of thrombus size to complications. The complication rate observed in PRO-TEE (embolic rate: 14%; death rate: 5.6%) was similar to reported series not using TEE to guide therapy, pointing to less selection bias.

Thus, we maintain that TEE is essential in the management of patients with suspected PVT. The PRO-TEE registry, although retrospective, identified for the first time the threshold of a "small clot" beyond which risk of complications increases with thrombolysis. Thrombolysis has the least complications with thrombi ≤ 0.8 cm² and no previous stroke. In these patients, thrombolysis in our opinion should be a first-line therapy, regardless of functional class, unless contraindications are present. With larger thrombi, risk of complications appears to be incremental. Although thrombolysis is not an absolute contraindication in patients with larger thrombi, the choice of thrombolysis versus repeat surgery in these

patients depends on the relative risk of each modality in a particular patient and institution. These recommendations await further validation in a prospective multicenter trial.

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Cardiologist in the Carotids

I read with interest the viewpoint by Dr. Gray (1), which reviews the case for carotid stenting. As an emerging technology, carotid stenting can be an important therapeutic modality for high surgical risk patients, and has the potential for expanded applications in additional patient groups.

What is the cardiac surgeon's role in the development and dissemination of carotid stents? Should one specialty alone be a gatekeeper for the introduction and performance of new endovascular procedures? Dr. Gray argues that cardiologists should be at the forefront of the wave to deploy endoluminal stents for carotid artery disease owing to their familiarity with complex percutaneous interventional procedures, and their ability to manage carotid-body-related medical issues. Cardiac and vascular surgeons are similarly capable of performing the technically demanding skills involved in carotid stenting, and they are also qualified to handle the postprocedure medical sequelae. Cardiac and vascular surgeons, in contrast to cardiologists, are capable of managing life-threatening and device-related surgical complications. However, catheter-based skills are absent from the curriculum of most

cardiac surgery training programs. Hence, a majority of graduating and practicing cardiac surgeons lack the necessary skills to routinely incorporate endovascular procedures into their practice.

Cardiac surgeons, cardiologists, interventional radiologists, and vascular surgeons should unite to develop multispecialty endovascular training programs and determine national credentialing standards for carotid stenting. Moreover, cardiac surgeons must take advantage of this opportunity to address the broader issue of endovascular training within our specialty. Vascular surgery has already incorporated endovascular experiences into their training regimens. As a result, many graduating vascular surgery residents possess catheter-based skills and are engaged in the practice of "endovascular surgery." The American Board of Thoracic Surgery should consider adding an endovascular component to the graduating certification requirements. Cardiac surgeons can currently obtain training in catheter-based procedures only through a limited number of nonaccredited fellowships. If cardiac surgeons are to be realistically involved in catheter-based procedures (and they should), it is time that cardiac surgery training programs either: 1) add individuals to their faculty with advanced endovascular skills; 2) encourage existing faculty to retrain in catheter-based procedures; or 3) allow their residents to spend quality time during their residency with clinicians who have extensive endovascular experience.

Who performs carotid stenting is a highly charged issue, and perhaps it will be the sentinel event that can bring diverse specialties together to create a national standard for training and credentialing in endovascular procedures. I believe the optimal solution will be a multidisciplinary based approach, so that qualified physicians from a number of specialties will be able to offer carotid stenting to their patients. Working through these issues now will also potentially make the introduction and dissemination of newer catheter-based therapies, such as percutaneous valves and cellular therapies for heart failure, more straightforward and less contentious.

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REPLY

Dr. Wheatley's letter appropriately raises several important issues related to carotid stenting, and the potential operators and pathways to becoming expert in this emerging field. However, my editorial (1) did not suggest cardiologists should be alone at the forefront of the "new wave" of carotid stenting. New operators are not assigned; rather, they declare themselves by virtue of interest, dedication, practice type, access to patients, training, and, yes, skill sets. It is noteworthy, however, that the significant majority of carotid stenting performed worldwide and in this country has been

by cardiologists and that both device development and the pivotal research owe much to that specialty (2). We would not be having this and other debates about specialty involvement had cardiology folded its tents under the barrage of criticism it received and had not proven the efficacy of carotid stenting.

Inclusion of cardiac surgeons to the current potpourri of cardiologists, vascular surgeons, radiologists, neurointerventionalists, neurosurgeons, and neurologists currently claiming a role in carotid stenting is not a priori a nonstarter. However, cardiac surgeons will be held to the same standards by most local hospital credentialing committees. This generally means that they will need to have all the requisite catheter-based skills (access, angioplasty, stenting, wire manipulation, etc.) that are generally acquired by noncardiologists by the performance of peripheral intervention. Further, they will need the rapid exchange and 0.014-inch wire experience necessary to move to carotid equipment. Practically speaking, access to the carotid patients and the ability to assess their clinical indications for carotid revascularization via interpretation of the various imaging modes currently available, the performance and interpretation of cerebral angiography, and judging the clinical appropriateness of any, and which, carotid intervention (surgical or endovascular) involves new cognitive skills that are achievable but require a dedicated effort. Finally, working on nonanesthetized patients has been a test for several specialties entering this field who are generally accustomed to it.

Although it appears that cardiac surgery may, in fact, be one of the specialties most challenged when it comes to making up the current deficits outlined above, Dr. Wheatley raises an important point: acquiring these requisite skills will serve the surgeon well as other technologies currently in development (percutaneous valve therapies, heart failure devices, and so forth) emerge for patients they are currently operating on. These skills will better position them to take part in, rather than to lose, the care of these patients. I would suggest those skills could be achieved without performing carotid stenting, where the consequences of complications may be irretrievable even by the surgeon and are devastating for all involved.

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Advantage of Percutaneous Coronary Intervention Over Medical Therapy in Angina Relief and the Placebo Effect

In the Medicine, Angioplasty, or Surgery Study (MASS-II) recently published in the *Journal*, Hueb et al. (1) compared the